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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to the electro photography photo conductor excellent in electrophotographic properties and endurance in more detail about an electro photography photo conductor.

[0002]

[Description of the Prior Art]In recent years, since it has the advantage that a high speed and high print quality are acquired, electrophotographic technology is widely applied in the field of a copying machine, a laser beam printer, etc. The thing using inorganic photoconducting materials, such as selenium, a selenium tellurium alloy, selenium and an arsenic alloy, and a cadmium sulfide, as an electro photography photo conductor used in such electrophotographic technology is widely known from the former.

[0003]On the other hand, compared with the electro photography photo conductor using these inorganic photoconducting materials, it is cheap and research of the electro photography photo conductor using the organic photoconducting material which has the advantage outstanding in respect of manufacturability and abandonment nature is also activated. Especially, since it excels in respect of electrophotographic properties, such as sensitivity, electrostatic property, and its repeated stability, various proposals are made and the organic lamination type photo conductor of the functional discrete type which laminated the charge generating layer which generates an electric charge by exposure, and the charge transport layer which conveys an electric charge is put in practical use.

[0004]Although what has sufficient performance is developed about the above-mentioned electrophotographic properties about these organic lamination type photo conductors, Since the photosensitive layer comprises organic materials, are inferior to the endurance to mechanical force external, Therefore, there is a problem that the photo conductor surface is

worn out by contact with a toner, a developer, a paper, a cleaning member, etc., or a crack etc. occur, and there is a problem that image quality defects produce toner filming etc. by adhesion of a foreign matter. There are a problem etc. of the image flowing under the high-humidity environment by which the paper powder etc. which are produced by low resistance substances and copy papers, such as ozone, nitrogen oxides, etc. by which it is generated by corona discharge, are caused in the photo conductor surface by carrying out adhesion accumulation, and the life of a photo conductor is restrained remarkably. With colorization of a copying machine, a printer, etc., and improvement in the speed, complication of a process and high stress-ization are progressing and the improvement of endurance to an electro photography photo conductor is called for also from these points. In order to solve these problems, the using [the measure against the conventional versatility is worked on, for example,]-as binding resin of photo conductor surface layer-polymethyl-methacrylate-resin, polyester resin, polycarbonate resin, etc. thing is proposed. (JP,60-172044,A, a 62-247374 gazette, a 63-148263 gazette, JP,2-254464,A)

[0005]

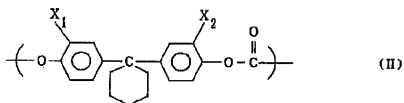
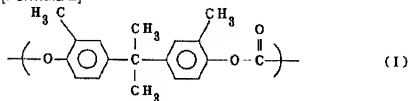
[Problem(s) to be Solved by the Invention]However, if the resin by which the conventional proposal was made is used as binding resin of a photosensitive layer, the electro photography photo conductor of comparatively good endurance will be obtained, but it cannot yet be satisfied enough. Namely, the mechanical strength of the coat formed using those resin, Since the thickness of a photosensitive layer decreases and sensitivity falls when wearing the surface of a photosensitive layer out when it cannot necessarily be said as sufficient thing but prolonged repeated use is carried out in a copying machine, fogging arises, or electrification potential falls to a copy and copy density falls to it. It had the problem that image quality defects occurred by adhesion of foreign matters, such as a crack produced in the photosensitive layer surface or toner filming. When a photosensitive layer has further again a charge transport layer which comprises a charge transporting material and binding resin, the compatibility of binding resin and a charge transporting material becomes important, and when compatibility is bad, A charge transporting material crystallizes and having an adverse effect remarkably to an electrical property and the image quality characteristic is known. Therefore, binding resin is required to excel also in respect of compatibility with a charge transporting material.

[0006]Therefore, in view of the above actual condition of conventional technology, this invention is made in order to solve the problem. That is, the purpose of this invention is to provide the electro photography photo conductor which has the outstanding electrical property and image quality characteristic, without holding high film strength, and having the outstanding abrasion resistance, and producing foreign matter adhesion, such as toner filming.

[0007]

[Means for Solving the Problem]As a result of repeating research wholeheartedly, by using it as binding resin of a photosensitive layer combining a certain specific resin, this invention persons find out attaining the above-mentioned purpose, and came to complete this invention. Namely, an electro photography photo conductor of this invention comes to provide a photosensitive layer at least on a conductive substrate, and this photosensitive layer as binding resin, Polycarbonate resin which consists of a repeated structure unit shown by following structural-formula (I), and polycarbonate resin which consists of a repeated structure unit shown by following structural-formula (II) of low molecular weight rather than this polycarbonate resin are contained.

[Formula 2]



(X₁ and X₂ express a hydrogen atom or an alkyl group among a formula, respectively.)

[0008] Hereafter, this invention is explained in detail. The electro photography photo conductor of this invention has a photosensitive layer at least on a conductive substrate. As the above-mentioned conductive substrate, metal, such as aluminum, nickel, chromium, and stainless steel. And the paper applied or impregnated with addition-of-conductivity material, plastic films, etc., such as a plastic film which provided thin films, such as aluminum, titanium, nickel, chromium, stainless steel, gold, vanadium, tin oxide, indium oxide, and ITO, are raised. Although these conductive substrates are used as a thing of proper shape, such as the shape of a drum, a sheet shaped, and plate shape, they are not limited to these. Furthermore, if needed, the surface of a conductive substrate is a range which does not have influence in image quality, and can perform various kinds of processings. For example, scattered reflection processings of graining etc., such as oxidation treatment, a surface chemical treatment, coloring processing, etc. can be performed.

[0009] In this invention, an under-coating layer may be provided on a conductive substrate. This under-coating layer shows a catoptric light prevention operation of light of a conductive

substrate, etc. depending on an operation as a glue line which carries out adhesion maintenance of the photosensitive layer temporarily to a conductive substrate with an operation which prevents pouring of an electric charge from a conductive substrate at the time of electrification of a photosensitive layer to a photosensitive layer, or the case.

[0010]As binding resin used for this under-coating layer, polyethylene resin, polypropylene resin, An acrylic resin, methacrylic resin, polyamide resin, vinyl chloride resin, Vinyl acetate resin, phenol resin, polycarbonate resin, polyurethane resin, Polyimide resin, vinylidene chloride resin, polyvinyl-acetal resin, Polyvinyl chloride acetate copolymer resin, polyvinyl alcohol resin, Water-soluble-polyester resin, a nitrocellulose, casein, gelatin, Publicly known materials, such as polyglutamic acid, starch, starch acetate, amino starch, polyacrylic acid, polyacrylamide, zirconium chelate compound, titanyl chelate compound, a titanyl alkoxide compound, an organic titanyl compound, and a silane coupling agent, can be used.

[0011]Although what is necessary is just to apply coating liquid containing the above-mentioned material in order to form an under-coating layer, as a coating method, Usual methods, such as a braid coating method, a wire bar coating method, a spray coating method, a dip coating method, a bead coating method, the air-knife-coating method, and the curtain coating method, can be used. 0.01-10 micrometers of thickness of an under-coating layer are preferably set as the range of 0.05-2 micrometers.

[0012]In this invention, even if a photosensitive layer formed on a conductive substrate is layer structure, it may be a thing of a laminated structure by which functional separation was carried out at a charge generating layer and a charge transport layer. When a photosensitive layer is a laminated structure, any of built-up sequence of a charge generating layer and a charge transport layer may be the upper layer. In the case of layer structure, a photosensitive layer comprises a charge generating material, a charge transporting material, and binding resin. In the case of a laminated structure, a charge generating layer comprises a charge generating material and binding resin, and a charge transport layer comprises a charge transporting material and binding resin.

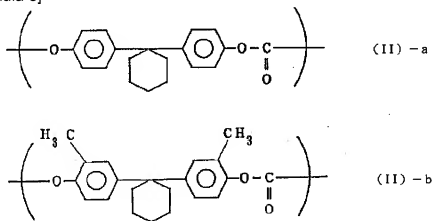
[0013]In this invention, as a charge generating material in the above-mentioned photosensitive layer, An amorphous selenium and crystallinity selenium tellurium alloy, a selenium arsenic alloy, other selenium compounds, and a selenium alloy, An organic color and colors, such as inorganic system photoconductivity materials, such as a zinc oxide and titanium oxide, a phthalocyanine system, a SUKUIRUMU system, an anthanthrone system, a perylene system, azo, an anthraquinone system, a pyrene series, pyrylium salt, and thia pyrylium salt, are used.

[0014]As a charge transporting material, oxadiazole derivatives, such as 2,5-bis(p-diethylaminophenyl)-1, 3, and 4-oxadiazole, Pyrazoline derivatives, such as 1,3,5-triphenylpyrazoline and 1-[pyridyl (2)]-3-(p-diethylaminostyryl)-5-(p-diethylaminophenyl) pyrazoline, The 3rd class of aromatic amino compounds, such as a triphenylamine and

dibenzylaniline, The 3rd class of aromatic diamino compounds, such as N,N'-diphenyl-N,N'-bis (3-methylphenyl)-[1,1'-biphenyl]-4,4'-diamine, 1, such as 3-(4'-diethylaminophenyl)-5,6-JI (4'-methoxyphenyl)-1,2,4-triazine, 2, 4-triazine derivative, Hydrazone derivatives, such as 4-diethylamino benzoic aldehyde 1,1'-diphenylhydrazone, alpha-stilbene derivatives, such as benzofuran derivatives, such as quinazoline derivatives, such as 2-phenyl-4-styryl quinazoline, and 6-hydroxy-2,3-JI (p-methoxyphenyl) benzofuran, and p-(2,2'-diphenylvinyl)-N,N-diphenylaniline, An enamine derivative indicated to "Journal of Imaging Science"29;7 - 10 (1985), To carbazole derivatives, such as N-ethylcarbazole, poly-N-vinylcarbazole and its derivative, a Polly gamma-carbazole ethyl glutamate and its derivative, and a pan. Although publicly known charge generating materials, such as pyrene, polyvinyl pyrene, polyvinyl anthracene, a polyvinyl acridine, Polly 9-biphenyl anthracene, pyrene formaldehyde resins, and ethylcarbazole formaldehyde resins, can be used, It is not limited to this etc. It can be independent, or two or more sorts can be mixed, and a charge transporting material can be used.

[0015]In this invention, polycarbonate resin which consists of a repeated structure unit shown by said structural-formula (I) as binding resin of a photosensitive layer, and polycarbonate resin which consists of a repeated structure unit shown by said structural-formula (II) are used. As polycarbonate resin which consists of a repeated structure unit which is structural-formula (II) and is shown, denaturation polycarbonate resin which has a repeated structure unit shown by following structural-formula (II)-a and (II)-b is mentioned as an example.

[Formula 3]



When a photosensitive layer is a laminated structure, the above-mentioned polycarbonate resin can be used also as which binding resin of a charge generating layer and a charge transport layer, but it is preferred to use especially as binding resin of a charge transport layer.

[0016]As a molecular weight of the above-mentioned polycarbonate resin, In the case of the polycarbonate resin which consists of a repeated structure unit shown by said structural-formula (I), about viscosity average molecular weight, In the case of the polycarbonate resin

which consists of a repeated structure unit which the thing of the range of 30, 000-90,000 is used, and is shown by said structural-formula (II), the thing of the range of 20,000-50,000 is used. However, it is required to have a value whose molecular weight of the polycarbonate resin which consists of a repeated structure unit shown by structural-formula (I) in that case is higher than the amount of polycarbonate resin which consists of a repeated structure unit shown by structural-formula (II). It is because a detailed wear crack may occur in a photosensitive layer surface on the occasion of long-term use and toner filming may arise, when what has the former molecular weight lower than the latter is used.

[0017]As for a compounding ratio (weight) of polycarbonate resin which consists of a repeated structure unit shown by structural-formula (I), and polycarbonate resin which consists of a repeated structure unit shown by structural-formula (II), it is preferred to set it as the range of 95:5 thru/or 60:40. If a compounding ratio becomes larger than 95:5, it will be easy to produce toner filming, and if it becomes smaller than 60:40, it will become easy to generate a wear crack.

[0018]A photosensitive layer can be formed by distributing or dissolving the above-mentioned charge generating material, a charge transporting material or these both, and binding resin in a suitable solvent, and applying obtained coating liquid on a conductive substrate.

[0019]Hereafter, the manufacturing method is explained about a desirable case where a photosensitive layer has a laminated structure. The charge generating layer can apply coating liquid produced by making distribute or dissolve the above-mentioned charge generating material and binding resin in a suitable solvent, and can form it by drying.

[0020]In a charge generating layer, a compounding ratio (weight ratio) of a charge generating material and binding resin has the preferred range of 10:1-1:10. As a solvent used for coating liquid, methanol, ethanol, n-propanol, n-butanol, benzyl alcohol, methyl cellosolve, ethylcellosolve, The usual organic solvents, such as acetone, methyl ethyl ketone, cyclohexanone, methyl acetate, n-butyl acetate, dioxane, a tetrahydrofuran, methylene chloride, and chloroform, are raised, it can be independent, or two or more sorts can be mixed, and they can be used. As a coating method, usual methods, such as a braid coating method, a wire bar coating method, a spray coating method, a dip coating method, a bead coating method, the air-knife-coating method, and the curtain coating method, can be used. 0.05-40 micrometers of thickness of a charge generating layer are usually preferably set as 0.05-25 micrometers.

[0021]The charge transport layer can apply a solution in which a suitable solvent was made to dissolve said charge transporting material and said polycarbonate resin, and can form it by making it dry. As a solvent used for formation of a charge transport layer, Aromatic hydrocarbon, such as benzene, toluene, xylene, and chlorobenzene. Ketone, such as acetone and 2-butanone, a methylene chloride, chloroform, These partially aromatic solvents, such as

ether of annular [, such as halogenated aliphatic hydrocarbon such as ethylene chloride, a tetrahydrofuran, dioxane, ethylene glycol, and diethylether,] or straight chain shape, can be used. As for a compounding ratio (weight ratio) of a charge transporting material and binding resin, 10:1-1:5 are preferred. As a coating method, usual methods, such as a braid coating method, a wire bar coating method, a spray coating method, a dip coating method, a bead coating method, the air-knife-coating method, and the curtain coating method, can be used. Generally, 2-100 micrometers of thickness of a charge transport layer are preferably set as 10-40 micrometers.

[0022]Additive agents, such as an antioxidant and light stabilizer, can be added in a photosensitive layer in order to prevent degradation of a photo conductor by ozone and a oxidizing gas emitted in a copying machine or light, and heat. As an antioxidant, hindered phenol, hindered amine, a p phenylenediamine, an aryl alkane, hydroquinone, a spiro chroman, spiroindanone and those derivatives, an organosulfur compound, an organophosphorus compound, etc. are raised, for example. As light stabilizer, derivatives, such as benzophenone, benzotriazol, dithiocarbamate, and tetramethylpiperidine, are raised, for example. At least one sort of electronic receptiveness substances can be made to contain in an electro photography photo conductor of this invention for the purpose of improvement in sensitivity, reduction of rest potential, fatigue reduction at the time of repeated use, etc. As an electronic receptiveness substance which can be used for an electro photography photo conductor of this invention, for example, a succinic anhydride, a maleic anhydride, and a jib -- the ROM maleic anhydride. Phthalic anhydride, tetra bromine phthalic anhydride, tetracyanoethylene, Tetracyano quinodimethane, o-dinitrobenzene, m-dinitrobenzene, chloranil, dinitroanthraquinone, trinitro fluorenone, picric acid, o-nitrobenzoic acid, p-nitrobenzoic acid, phthalic acid, etc. can be raised. Especially a benzene derivative that has electron withdrawing substituents, such as a fluorenone system, a quinone system, Cl, CN, NO₂, is [among these] preferred.

[0023]

[Example]Hereafter, an example explains this invention. In an example, a "part" means a "weight section."

The solution which consists of ten copies of zirconium compounds (trade name: Olga Chicks ZC540, the Matsumoto Pharmaceuticals company make) and one copy of silane compound (trade name: A1110, made in Japanese Junker), 40 copies of i-propanol, and 20 copies of butanol on an example 1 aluminum-pipe base, It applied by the dip coating method, stoving was carried out for 10 minutes in 150 **, and the under-coating layer of 0.1 micrometer of thickness was formed.

[0024]Next, mix with one copy of polyvinyl butyral resin (trade name: S lek BM-S, Sekisui Chemical Co., Ltd. make), and 100 copies of cyclohexanones, and one copy of x type non-

metal-phthalocyanines crystal with a glass bead. After carrying out 1 time processing and distributing by a sand mill, the obtained coating liquid was applied by the dip coating method on the above-mentioned under-coating layer, stoving was carried out for 10 minutes in 100 °C, and the charge generating layer of 0.25 micrometer of thickness was formed.

[0025]Next, four copies of N-ethylcarbazole 3-aldehyde diphenylhydrazone, Two copies of polycarbonate resin (viscosity average molecular weight 39000) which consists of a repeated structure unit shown by polycarbonate resin (viscosity average molecular weight 62300) 4 weight section which consists of a repeated structure unit shown by said structural-formula (I), and said structural-formula (II)-a. The coating liquid obtained by dissolving in 50 copies of mono- chlorobenzene was applied by the dip coating method on the above-mentioned charge generating layer, it dried at 135 °C for 1 hour, and the electro photography photo conductor which consists of three layers was produced.

[0026]the existence of image quality defects equip with this electro photography photo conductor the copying machine (Fuji Xerox make: A-color630) which consists of semiconductor laser exposure, copy 30,000 sheets, and according to the wear, the crack, and toner filming on the surface of a photo conductor -- it investigated about the electrical property further. The result is shown in Table 1.

[0027]Instead of the polycarbonate resin which consists of a repeated structure unit shown by said structural-formula (II)-a in example 2 Example 1, Except having used the polycarbonate resin (viscosity average molecular weight 35000) which consists of a repeated structure unit shown by said structural-formula (II)-b, the electro photography photo conductor was produced like Example 1, and same evaluation was carried out. The result is shown in Table 1.

[0028]The thing of the polycarbonate resin (viscosity average molecular weight 80000) which consists of a repeated structure unit shown by said structural-formula (I) in example 3 Example 1 is used, Except having used the thing of the polycarbonate resin (viscosity average molecular weight 21000) which consists of a repeated structure unit furthermore shown by said structural-formula (II)-a, the electro photography photo conductor was produced like Example 1, and same evaluation was carried out. The result is shown in Table 1.

[0029]Except having set to 3:3 the compounding ratio (weight) of the polycarbonate resin which consists of a repeated structure unit indicated to be polycarbonate resin which consists of a repeated structure unit shown by said structural-formula (I) in example 4 Example 1 by said structural-formula (II)-a, The electro photography photo conductor was produced like Example 1, and same evaluation was carried out. The result is shown in Table 1.

[0030]In comparative example 1 Example 1, except having used as binding resin of a charge transport layer only the polycarbonate resin (viscosity average molecular weight 62300) which consists of a repeated structure unit shown by said structural-formula (I), the electro photography photo conductor was produced like Example 1, and same evaluation was carried

out. The result is shown in Table 1.

[0031] In comparative example 2 Example 1, except having used as 30000 the viscosity average molecular weight of the polycarbonate resin which consists of a repeated structure unit shown by said structural-formula (I), the electro photography photo conductor was produced like Example 1, and same evaluation was carried out. The result is shown in Table 1.

[0032]

[Table 1]

		電 気 特 性		画 質 特 性
		暗部電位 (V)	明部電位 (V)	
実施例 1	初 期	-700	-150	良好
	3万枚 複写後	-685	-160	初期と比較して全く 変化なく良好
実施例 2	初 期	-700	-150	良好
	3万枚 複写後	-680	-165	初期と比較して全く 変化なく良好
実施例 3	初 期	-700	-150	良好
	3万枚 複写後	-680	-165	初期と比較して全く 変化なく良好
実施例 4	初 期	-700	-150	良好
	3万枚 複写後	-675	-170	僅かな磨耗傷
比較例 1	初 期	-700	-175	良好
	3万枚 複写後	-670	-215	トナーフィルミングの 跡発生
比較例 2	初 期	-700	-150	良好
	3万枚 複写後	-680	-170	微細な磨耗傷及びトナー フィルミングの跡発生

[0033]

[Effect of the Invention] The polycarbonate resin in which the electro photography photo conductor of this invention consists of a repeated structure unit shown by said structural-formula (I) as binding resin, By using the thing containing the polycarbonate resin which consists of a repeated structure unit shown by said structural-formula (II), hold high film strength, and excel in abrasion resistance, and. It excels in an electrical property and the image quality characteristic, without producing adhesion of foreign matters, such as toner filming.

[Translation done.]